

Throughout this journey, I studied the effects of climate change on marine life and how climate change affects marine mammals on the Pacific coast. I researched different causes of climate change: How do we, as humans, begin to recognize that something bigger is going on? Climate change is not a simple issue and there are many dimensions to this ever-changing issue.

I explored the impact that climate change has on elephant and harbor seals, sea lions, whales, and dolphins. In this painting, I used acrylic paint to depict the changing oceans. The forgiving characteristics of using acrylic allowed me to experiment and practice with different tools and styles. I was able to paint over what I had already painted if I didn't like what I saw or wanted to try something different. Although I first saw this as a positive aspect of using acrylic paint, I also discovered some disadvantages. It almost allowed me too much freedom to experiment.

I have a deep connection to the ocean and a commitment to keep the environment healthy. I want this painting to communicate to the viewer that there is an issue and inspire them to get involved in organizations to create a more sustainable future. There are many small acts we can do to reduce our footprint; beyond that, we can actively involve ourselves in making bigger changes for the health of the planet's oceans.

Savilia

# Becoming the Change

Savilia



*In this paper, I delve into the positive and negative effects that climate change is having on marine mammals and ecosystems along the Pacific Coast. I touch on its effect on sea lions, sea elephants, seals, and whales, as well as describe how climate change is changing the physical characteristics of the ocean.*

Growing up I spent a lot of time on the ocean and exploring Tomales Bay. Tomales Bay is a body of water that comes in from the Pacific Ocean, connecting the deep waters with the stretching wetlands. The bay is about thirteen miles long and no wider than two miles at its widest points. At the bottom of the bay the seawater flows into a wetland. I developed an awareness for sea life and their well being at a young age by spending endless hours on the bay. I was fascinated by the entire world under and around the sea. It never occurred to me at a young age that there would ever be anything that would put the life in the ocean in danger. I have strong memories of waking up early in the fog, slapping sunscreen on and packing peanut butter and banana pancake sandwiches to spend “science day” on Tomales Bay with my dad and two older brothers studying krill and taking samples, which we would later observe under a microscope, from our small skiff. On other days we would rake the banks of the



wetlands and lower parts of Tomales Bay, picking up trash. When I was in elementary school my brothers and I did a project with the West Marin Watershed on Tomales Bay. It was called the Tomales Bay Clean Up. We would go out onto the bay into the wetlands and pick up trash along the banks of the bay. I was amazed at how much trash we picked up. We collected pieces of trash from tennis balls, to a motorcycle helmet, to a full bodied port-a-potty. At the end of the school year we built a car sculpture out of the trash and drove it in the local parade. I remember the irony as we drove behind another float, decked out in sparkly balloons and streamers, and as I looked again at our own float, I noticed these same objects in our trash sculpture.



One day, we were near the mouth of the bay where the shallower waters of the bay meet the ocean. There is a strong current across the mouth with dangerous rip tides. The strong currents here often sweep debris into the bay. We were drifting in our skiff near the cliffs taking samples of krill and plankton. I gazed across the bow of the boat at the waves crashing against the barnacle covered rocks. I watched one large rock, farther out from the cliff in the deeper water.

Was that a rock? I blinked and a fountain of water burst out of the top. It was a whale! This was the first time I had seen a whale so close. I was overcome with excitement and bewilderment as I watched this huge animal glide gracefully through the water. I was also quickly hit with concern

as I realized it was far from the deep cold waters of the ocean, and instead swimming in the warm and shallow water of the bay. Why was it here? You would normally see these animals from a distance from an ocean shore breaching in the open ocean. After this encounter with the whale I learned what happens occasionally, when a lone whale wanders into the bay. It typically cannot find its way out and will eventually wash up on the shores of the beaches because it cannot escape the shallow waters and starves because there is inadequate food. This was one of the first times when I realized marine mammals in my community were endangered. This experience made me question what else was going on with the marine mammals, and led me to my first question I posed in my research: How do we start recognizing that something bigger is going on? For me, this was the initial experience that provoked this idea.

It is because of these experiences that I had growing up and my unique relationship with the ocean and coastal animals around where I grew up, that I cultivated a strong connection with the marine environment. I see this project as an opportunity to educate myself on a serious issue that our world faces today. Climate change. Climate change is a large topic with many layers. I want to focus on how it is affecting marine life along the Pacific Coast close to where I grew up. Although I have a strong relationship with the ocean and a deep care and concern for it, I don't know that much about what is really happening to the marine mammals with the current changes in climate, or about what I can do as an individual to soften my impact. In school I had always heard the phrases "climate change", and "global warming", but honestly I never really knew what those words meant, and I'm not sure the people who were saying them did either. My research in this paper is meant to highlight the change that is happening in the oceans due to climate change and grasp a better understanding of what we can do to stop it.

My driving question for my research is to study how climate change is affecting marine mammals on the Pacific Coast. In my research I interviewed and investigated how it is affecting different species of whales that are seen migrating and those that do not migrate along the Pacific coast, as well as the effects on harbor seals, sea lions, elephant seals, and changes in coastal plants and sea algae. I spoke with experts, writers, and researchers, some local to the area where I grew up around Point Reyes, California.

Maybe one of the widest seen issues we are seeing in our coastal waters is an increase in water temperatures up and down our coasts. This effect is proved to be caused by large amounts of greenhouse gases released into the environment, a result of human activity. The rise in ocean temperature effects the water on the surface to a depth of about 2300 feet, where most marine life thrives. According to an interview with the Santa Barbara Marine Mammal Center (SBMMC), the ocean water on the California coast has been rising since 2013. This constant period of unnatural water temperature has not given the animals any recovery time. According to Adam Ratner, Guest Experience Manager at the Marine Mammal Center, in the past we have seen increased water temperatures but only for short periods of time, and always followed by a "cool off" period, giving the animals time to recover. Sea lions are now being forced to swim farther out to sea where the water is much colder and of "normal" temperatures to find their food. Salmon thrive in cold waters so they leave the warm coastal water and inhabit the deep ocean waters. The effects of temperature rise is concerning to the survival and population levels of sea lions and elephant seals and is leading to a rise in starvation among sea lion pups because they cannot travel as far as necessary for food. According to the Adam Ratner at the SBMMC they have even observed starvation in mothers and large males because they cannot get their food on shore.

Warming waters are also causing similar problems for elephant seals. When the elephant seals are finished nursing, their mothers leave them to fend on their own. As a result of warming ocean temperatures, the pups now have to swim farther out to the cold waters to get their food. This is causing a problem for the pups because they are too weak to swim this far and are unable to feed themselves on their own. Similar to sea lions, elephant seal pups are starving all along the California coast. During an interview with Sarah Allen, Ocean and Coastal Resources program Coordinator at the National Park Service, I learned many populations of elephant seals and sea lions are disappearing from breeding grounds in the bay area. For example, sea lions have fled a once popular breeding shore at the Point Reyes Headlands. The effects of warming water temperatures vary, and for some species it is showing a positive effect. Warming water temperatures is showing a positive effect on the bottlenose dolphins which actually prefer warmer waters. This is leading to new sightings of the bottlenose where we haven't seen them previously. Although this is a seemingly positive result for the bottlenose dolphin, I question if it could lead to negative impacts on other species living in these areas.

Another aspect of global warming is the melting of the ice caps in the arctic. The melting of the arctic is caused by human activity and the release of greenhouse gases and carbon dioxide, which warms the oceans and air, which in turn, begins to melt the ice in the arctic. This is having big effects all over the world. Specifically, I researched how it is effecting whales. I focused on the species of whales seen migrating up the Pacific coast like the Gray Whales. Although the melting ice poses a lot of negative effects to animals like the polar bear and plankton which thrives underneath the ice, its effect on the Gray and Orca whales is positive according to the Santa Barbara Marine Mammal Center. The melting ice is opening up new migratory routes for the Gray Whale. The Gray Whale has not been seen in the Atlantic Ocean in more than 200 years until recently it just appeared. This is because until recent years, the ice on the arctic has been too thick for any migratory paths to be made through it. The SBMMC is seeing this mostly as a positive change because it has opened up new migratory routes for the gray whale. We will likely see a growing population of this species. Although researchers are seeing this as a positive affect to the Gray Whales, I question if it will have negative repercussions for other sea life in these areas.

During my interview with Sarah Allen, she highlighted another effect of climate change: rising air temperatures. Rising air temperatures recorded in Southern and Central California are effecting pinnipeds. Pinnipeds depend on a thick layer of blubber to keep them warm in cool ocean temperatures, but when they come onshore they overheat. Seals are seen spending more time in water and have adapted to a thermal window.

Adam Ratner from the Marine Mammal Center also described the occurrence of warm water blobs that have recently been sighted in the pacific. One was seen off the California coast and another recently seen in Alaska. In an interview with Bill Peterson, a member of NOAA, he describes information they have collected from copepods, small krill animals, which many whales feed off of. "The copepods tell us that water came from a long ways away, this water just didn't sit there and warm up. It came from someplace different." The warm water blobs have confounded after the most recent El Nino. Researchers are seeing humpbacks, which usually travel to the arctic to feed, not going to the arctic and instead have been spotted feeding in the San Francisco Bay and even the Columbia River due to a shift in their prey. There is still little information on these mysterious warm water blobs. Will they continue to occur? Will the impact it is already having on the whales lead to a bigger problem for the marine ecosystem?

So what now? Global climate change is a huge issue. So huge, it's difficult to even explain as one thing. There are many layers, and levels of impact, and it is changing everything about the environment, everywhere all around the world. It's an issue that we need to step up to, educate ourselves, and take the first step towards action. For some of us, the first step is just acknowledging that it exists. There are countless small acts that we all can participate in like using public transportation, switching light bulbs to LED, and using reusable bags when going to the grocery store. But instead of passively explaining how we can all take part in these activities, I want to illustrate an issue that I am personally invested in the banning of carry out plastic bags from grocery stores. According to Ocean Crusaders, shoppers worldwide use approximately 500 billion single-use plastic bags per year. A large percentage of those 500 billion plastic bags end up in the ocean, adding to the 5.25 trillion pieces of plastic debris that float in our oceans. This pollution has a detrimental impact to marine mammals. Turtles often mistake plastic bags for food, leading to the trash getting stuck in their throats which leads to suffocation. Sea lions, elephant seal, whales, and dolphins, get trapped in tangles of garbage and often are unable to escape. A quote from the National Conference of State Legislators states "In August 2014, California became the first state to enact legislation imposing a statewide ban on single-use plastic bags." This means large retail stores would now ban plastic bags at the checkout. This law however did not get put on the ballot until November of 2016. The law was passed earlier this year. The point of me explaining this is to show that this is the kind of change that we can get involved in easily. In some instances it just takes a mark of the pencil to create greater change. We have to use our voices for the animals of our oceans. We are responsible for climate change and we are also what can turn it around, if only we act.

Climate change is shifting the environment. It is changing ecosystems, shifting populations, and species all along the Pacific Coast. The change in Gray Whale migration and Orca Whale feeding routes will continue to change as the Arctic continues to disappear. With no sign in sight of ocean temperatures returning to "normal" we will likely see dramatic changes in species population in elephant seals and sea lions. My research stemmed from my love for the ocean and my childhood experience working on Tomales Bay. I was interested to learn more about the affects of climate change on the ecosystems near me. Although not all the affects I learned about are considered negative, I don't believe climate change is going to positively help our planet. The impact humans are having on the planet today is unsustainable. There's plenty of scientific data to prove that, but how do we make all of human kind recognize this? And not only recognize it, but then take the next step to rehabilitate our planet and plan towards a sustainable future?

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